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The Energy Transition Experiment in Germany

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Abstract:

Germany has sought to accomplish an energy transition by progressively shifting from dependence on fossil fuel sources to reliance on various forms of renewable energy sources. This transition is facilitated through the implementation of a range of legislative measures that align with the goals of the energy transition program. Furthermore, Germany leads in European scientific research, prioritizing the involvement of the private sector. These initiatives have resulted in positive outcomes in the German energy market, prompting the development of infrastructure for renewable energy sources. Consequently, their contribution to Germany's energy supply has seen a gradual rise.

Key words: Energy transition, renewable energies, depleted energy resources.

JEL Classification Codes: P28, Q49.

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Introduction:

The negative effects resulting from the consumption of renewable energy sources, notably the significant pollution witnessed by the global economy since the Industrial Revolution to the present day, have led to serious complications threatening the lives of current and future societies. These encompass health impacts resulting in the emergence of serious diseases due to pollution, which has negatively impacted environmental life. Furthermore, the non-renewable nature of traditional energy resources worsens and intensifies these issues.

These negative effects have compelled the global community to act, convening numerous international conferences and progressively shifting away from fossil fuel sources. Instead, they're embracing renewable energy sources as an effective alternative that aligns with environmental preservation and the interests of future generations.

General problematic and partial problematic:

Given Germany's status as a leading advocate and pioneer in adopting energy transition, this has driven it to focus on prioritizing the development of the renewable energy sector as a crucial means of combating climate change. This initiative aims to protect the interests of future generations and ensure a sustainable energy supply for the German economy. Consequently, based on the aforementioned points, the following issue can be raised:

- What are the primary key initiatives that Germany has undertaken to achieve the energy transition?

From this question, we raise the following sub-questions:

- What is meant by energy transition, and what are its requirements?
- What measures has Germany adopted to develop the renewable energy sector?
- What are the most significant outcomes achieved by Germany in the renewable energy sector?

General hypothesis and partial hypothesis:

To attempt to address the main problematic and sub-questions, the following hypotheses were adopted:

- The German model is considered a pioneering model globally in the field of energy transition.
- The development plan for the renewable energy sector is comprehensive, as Germany has sought to develop and utilize all renewable energy sources.
- Renewable energy sources in Germany are considered an effective alternative that compensates for traditional energy sources such (oil, gas, and coal).

Objectives and importance of the study:

This study aimed to achieve several objectives, including:

- Underscoring the economic and environmental significance of energy transition.
- Highlighting the significant efforts undertaken by Germany to advance the field of renewable energies.
- Evaluating the achievements made in the renewable energy sector in Germany and assessing their contribution to the development of the German economy.

Methodology applied:

To encompass different facets of the subject, a descriptive approach was employed. This included discussing key concepts and analyzing a range of economic data concerning the renewable energy sector in Germany

The division of the research:

To address the main question of the topic, the study is structured into the following dimensions:

- Understanding energy transition.
- Germany's energy transition program.
- Impacts of Germany's energy transition program on the renewable energy sector.

First Axis: The nature of energy transition

Given the significant economic and environmental importance associated with the current discourse on energy transition, there has been a diversification and proliferation of economic literature addressing this subject. This literature explores various theoretical aspects that elucidate the concept of energy transition from different perspectives.

1- **Definition of Energy Transition:** Various definitions have been put forth for the concept of energy transition. Some of these definitions are as follows:

The notion of energy transition emerged in Germany and Austria in 1980 as a collection of scientific forecasts and proposals formulated by the "Oeko" Institute with the objective of finding an alternative to oil. Energy transition signifies more than just the transition from a system reliant on non-renewable energy production and consumption; it also involves an increase in the proportion of reliance on renewable energy sources. The measurement of energy transition is gauged by the quantity of renewable energy consumption or production relative to overall consumption or production (Tahtouh et al., 2019).

It's a fundamental element of environmental transition, indicating the shift from the current energy system (reliant on non-renewable resources) to an energy mix primarily based on renewable resources. This implicitly means developing alternatives to fossil fuels, which are considered limited and non-renewable resources, as well as some types of nuclear fuels (such as radioactive materials like uranium and plutonium). Energy transition facilitates the progressive replacement of conventional energy with renewable energy sources (Ben Abou et al., 2017).

The energy transition refers to the shift from an energy production and consumption system primarily based on non-renewable fossil fuels to a more diverse energy mix characterized by lower carbon intensity and higher proportions of renewable energy sources. One of the characteristics of energy transition is its variation from one country to another depending on the energy mix, economic potentials, technological capabilities, and adopted policies. It is a complex and lengthy process associated with political will, economic and environmental realities, governance quality, societal culture, and shifts in fossil and alternative energy markets (Daas et al., 2022).

2- The main objectives of energy transition can be summarized as follows (Ghouas et al., 2021):

- Diversification of the overall economy's energy resources.
- Preservation of fossil energy resources.
- Diversification of energy sources and reduction of dependence on fossil energy resources such as oil and gas.

- Environmental protection and contribution to international efforts to mitigate carbon dioxide emissions.

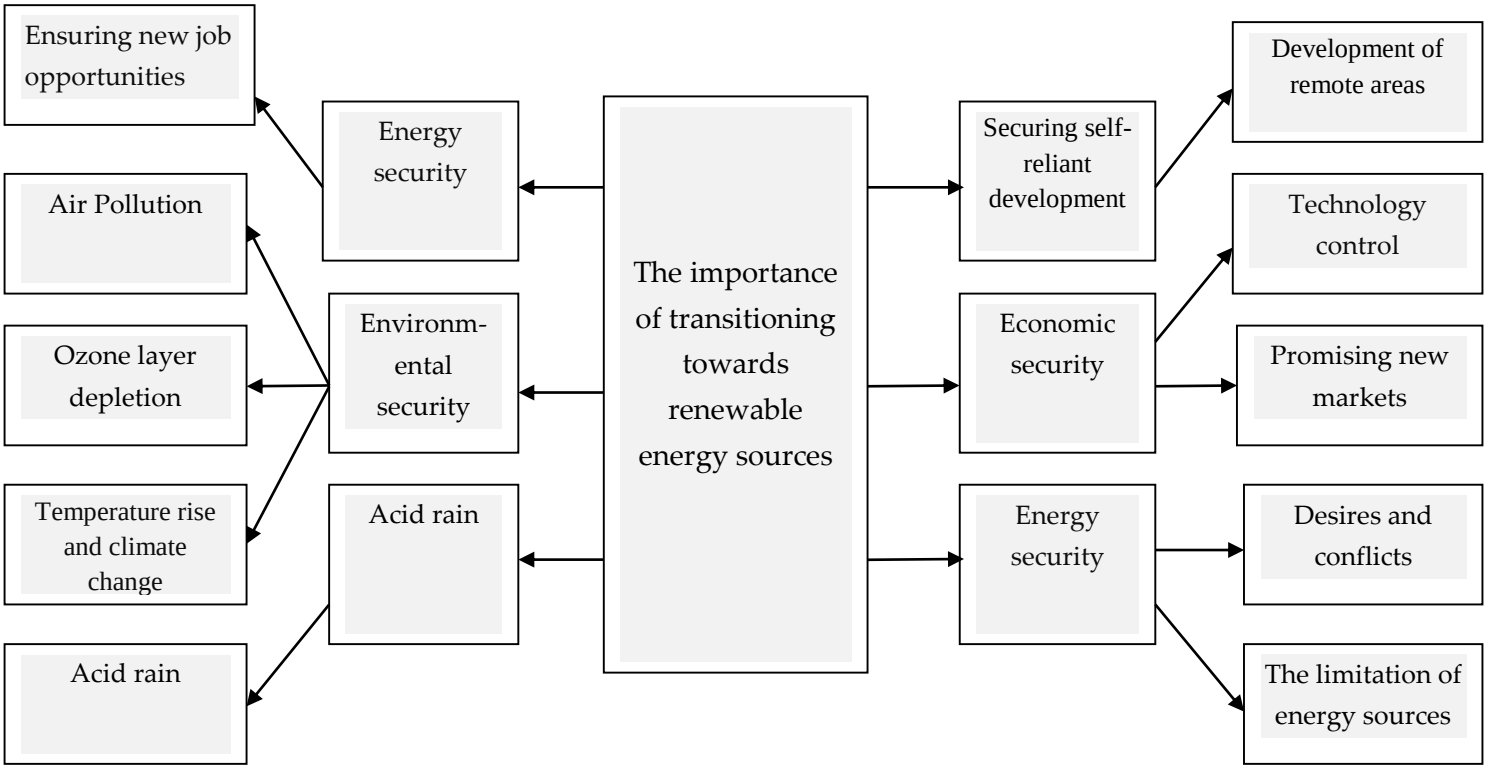
3- The primary requirements for energy transition are as follows (Malki et al., 2020):

- Clear political will from national leadership to gradually phase out fossil fuels in favor of renewable energy sources.
- Provision of necessary financial liquidity for energy transition through finding financing mechanisms for renewable energy projects, involving the private sector, and encouraging foreign investment in this field.
- Creation of new markets for renewable energies through this transition.
- Establishment of international agreements and partnership contracts to develop renewable energy generation and industry.
- Promotion of scientific and technological research in the field of renewable energies.
- Opening up markets for renewable energies characterized by flexibility and transparency in transactions.

4- The significance of energy transition:

The importance of energy transition is profound as it contributes to achieving energy security and economic stability by opening up promising new markets. Furthermore, it ensures independent development for remote areas and fosters social security through the creation of new job opportunities. Moreover, energy transition plays a critical role in environmental security by combating ozone depletion, mitigating temperature rise, and addressing climate change. The following figure illustrates the significance of energy transition:

Figure No. (01): The importance of energy transition



Source: Abd Eldjawad, M. A. (2004). Residential Buildings with Renewable Energy Supply: A Master's Thesis. Ain Shams University, Egypt, p. 60.

5- Motivations for the shift towards energy transition include (Chebat et al., 2022):

5-1 Population growth and concerns about fossil energy depletion (Energy Security):

The world has witnessed a significant and accelerating population growth since (1950), with projections indicating a population of nine billion by (2050). This trend translates to heightened human energy demands, with some studies predicting energy consumption reaching (203) trillion cubic feet by (2040). This situation raises concerns about the depletion of fossil energy resources if current consumption rates persist. According to some global studies, fossil energy depletion may be imminent if consumption rates continue at their current pace.

5-2 Increasing international pressure on climate change:

The negative impacts of fossil fuels on the climate have increasingly spread, prompting mounting pressure and calls to action against environmental pollution. This phenomenon has led to escalating demands and appeals from international organizations, environmental advocacy groups, and the media, as well as various public spheres on a global scale. Consequently, governments and official authorities have been compelled to respond swiftly to these demands and pressures. This is evidenced by the plethora of international conferences convened to address these issues, resulting in the signing of several treaties and agreements, such as the Kyoto Protocol on climate change and the Copenhagen Agreement (2009), aimed at reducing greenhouse gas emissions by 50% by (2020).

5-3 Oil price volatility and growing political pressures:

Following the end of the October (1973) war between Arab nations and Israeli occupation, the industrialized world, led by the United States, began to recognize the looming energy crisis. Fuel prices witnessed a twofold increase compared to their (1970) levels. This situation resulted in a deficit in the balance of payments for industrialized nations, as they were the primary consumers of fossil fuels.

5-4 Increasing importance of renewable energy in advancing social development:

Renewable energies play a crucial role in advancing various social aspects. They contribute significantly to alleviating energy resource shortages in many marginalized communities that lack traditional distribution networks. This, in turn, enhances access to education and modern communication facilities.

Furthermore, renewable energy sources create new job opportunities. According to a report by the International Renewable Energy Agency in (2017), the renewable energy sector provides permanent employment for approximately (8.9) million people worldwide.

The second axis: Germany's energy transition program

As part of the German authorities' efforts to develop the renewable energy sector to play an effective role in meeting the energy needs of the German economy, they have taken

several effective measures to stimulate continuous growth and development of various renewable energy sources.

1- A historical overview of energy transition in Germany:

Germany's renewable energy policy began in (1974) following the first oil crisis. For approximately a decade, this policy primarily consisted of promoting research through employee training to develop initial prototypes. Spending was initially modest, estimated at around (10) million euros in 1974, gradually increasing to about (60) million euros by (1978) and peaking in (1982) at around (150) million euros. However, it declined thereafter, reaching (82) million euros in (1986). Since (1979), there were also initial efforts to stimulate demand for renewable energy sources through tariff usage. At that time, the government relied on the National Competition Act to compel distributors to purchase electricity from renewable sources produced in their supply region on a cost-avoidance basis. In (1978), the German parliament approved the establishment of the Enquete Commission on Precautionary Measures to Protect the Earth's Atmosphere, tasked with studying ozone depletion, climate change, and proposing action. Additionally, a joint working group between ministries was established to reduce carbon dioxide emissions. The commission recommended a (30%) reduction in nitrous oxide and methane emissions by (2005) and an (80%) reduction by (2050) (Mez, 2004).

2- Legal Measures for Energy Transition:

The prosperity of renewable energies in Germany did not emerge out of a vacuum; rather, it resulted from various factors, including significant legal measures and Germany's keen interest in climate and renewable energy issues. Among these measures are (Abas et al., 2019):

- Issuance of the first law regarding renewable energy on January 01, 1991, concerning electricity networks.
- Signing of the United Nations Framework Convention on Climate Change in Rio in (1992).
- Signing of the Kyoto Protocol in (1998), committing to reducing greenhouse gas emissions by (21) percent.

- Issuance of the German Energy Industry Law (Energy Market Liberalization).
- Issuance of the Renewable Energy Sources Law in the year (2000).
- Gradual approval of reducing dependence on nuclear energy in (2002).
- Renewable Energy Sources Law for the year 2004, focusing on increasing the share of renewable energy in electricity supplies by 12.5 percent in (2010), and 20 percent in (2020).
- The Renewable Energy Sources Law of (2009), which called for the necessity of curbing excessive demand in photonics sector.
- The Renewable Energy Sources Law of (2012) aims to increase the contribution of renewable energy sources and raise energy supplies by at least 35% by (2020), 50 % by (2030), 60 % by (2040), and 80 % by (2050).
- The Renewable Energy Sources Law of (2017): Its main features include (Mira et al., 2016):
- Introducing an auction system for most renewable energy sources (wind energy, solar energy, biomass).
- Further expansion in the use of solar energy.
- Introduction of the so-called centralized model for offshore wind energy facilities.

2 - Encouraging investment in the field of renewable energies, this is achieved through (Khelalef et al.,2021):

2-1 Infrastructure Development: Germany has constructed (22,000) wind turbines in the northern part of the country near the shores of the North Sea to harness the strong winds in that region, and encourages residents of southern cities to install solar panels in their homes to convert solar energy into electricity for lighting and heating purposes. Furthermore, new infrastructure is being built to accommodate the transition to renewable energy. Many German economic research centers anticipate that the cost of developing this infrastructure will range between (125) billion and (250) billion US dollars to be spent over (8) years. This substantial amount equals approximately 3.5% to 7% of Germany's total GDP for the year (2011).

2-2 Tax Increases: The German government has moved towards raising electricity fees on citizens as an additional tax to support renewable energy. This increase has been estimated at 10%. While this may seem costly, on the other hand, supporting renewable energy and developing environmentally friendly green industrial and technological processes has provided the country with exports worth $12 billion USD, which is expected to increase.

2-3 Private Sector Encouragement: Germany has placed significant emphasis on the private sector to produce renewable energy. It has heavily relied on companies like Siemens and Germany Energy to develop energy storage solutions. These companies have already built (31) energy storage stations nationwide, utilizing water-derived energy, and have also worked on developing lithium-ion batteries, similar to those found in mobile phones, for energy storage.

3- Focus on Scientific Research in Renewable Energies:

German universities are offering young individuals the chance to study and specialize in renewable energy. This is to advance technologies for renewable energy production and discover new techniques for generating eco-friendly energy. In (2007), there were merely seven specializations in this field, but now there are over (25) specializations across various faculties (Abas et al., 2019). In terms of scientific research, $79.7 billion has been invested in the renewable energy sector, equivalent to the entire GDP of Luxembourg in 2020 (Renewables, 2022).

The Third Axis: Implications of Germany's snergy transition program on the renewable energy sector

In this axis, we explore the diverse accomplishments resulting from Germany's substantial efforts in advancing the renewable energy sector. This includes significant contributions to energy generation from various renewable sources and its role in fostering the development and growth of the German economy.

1- Development of electric charging stations from renewable sources in Germany:

The number of electric charging stations powered by various renewable energy sources in Germany has shown a remarkable increase from (2012) to (2021). In

(2012), there were only (1,000) such stations, but over the span of just (10) years, this figure soared to (52,000). This upward trend underscores the German authorities' serious commitment to phasing out traditional energy charging stations in favor of those powered by renewable energy sources. The table below shows the development of electric charging stations from renewable sources in Germany during the period from (2012) to (2021):

Table No. (01): The evolution of electric charging stations from renewable sources in Germany during the period (2012-2021)

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number of electric charging stations	1000	2000	3000	4000	7000	11000	20000	30000	40000	52000

Source: Federal Ministry For Economic Affairs and Climate action,2022,p39

2- **Contribution of renewable energy to total energy in Germany:** The proportion of renewable energy sources in Germany's overall energy consumption showed a consistent rise from (2010) to (2020). In (2010), it stood at 11.4%, increasing steadily until (2016) to reach 14.9%. However, in (2015), this figure slightly declined to 15.2%, and this is attributed to the decrease in petroleum prices, leading to heightened consumption and demand. Subsequently, (2017) marked the beginning of an upward trajectory, with the contribution reaching 19.6% by (2020). The following table depicts the percentage contribution of renewable energy sources to Germany's total energy consumption during the period (2010-2020):

Table No. (02): Contribution of renewable energy to total energy in Germany during the period (2010-2020)

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
The percentage of renewable energy out of Germany's total energy: %	11.4	12.5	13.6	13.6	14.3	15.2	14.9	16	16.8	17.7	19.6

Source: Federal Ministry For Economic Affairs and Climate action,2022,p83

3- Generation of electricity from renewable sources in Germany during the period (2011-2021):

The contribution of renewable energy sources to electricity production in Germany saw a continuous increase over the years. In (2021), it amounted to (233.6) million kilowatt-hours, accounting for 41.1% of the total. Over the span of a decade (2011-2021), there was a significant rise in electricity production from renewable sources, with an increase of (109.2) million kilowatt-hours, marking an 87% increase compared to (2011). Wind energy stands as the primary contributor to Germany's renewable energy mix, generating (95) million kilowatt-hours in (2021), constituting 40.66%. Following wind energy, biomass contributed (55) million kilowatt-hours (23.54%), solar energy (44.1) million kilowatt-hours (18.87%), hydropower 35 million kilowatt-hours (14.98%), and geothermal energy (4.5) million kilowatt-hours (1.9%) of the total electricity generated from renewable sources in Germany in (2021). The following table illustrates the electricity generation from renewable sources in Germany during the period (2011-2021):

Table No. (03): Generation of electricity from renewable sources in Germany during the period (2011-2021)
Unit: Million Kilowatt-hours

Year	Hydropower	Biomass Energy	Wind Energy	Solar Energy	Geothermal Energy	Total	Percentage
2011	20	35	45	22	2.4	124.4	20.4
2012	25	38	49	30	1.4	143.4	23.6
2013	25	45	50	30.7	1.2	151.9	25.1
2014	30	50	52	27.9	2	161.9	27.3
2015	28	48	79	30	3.1	188.1	31.4
2016	27	52	82.6	25	2.5	189.1	31.6
2017	30	56	96	30	3.7	215.7	36
2018	32	58	98	31	3.9	222.9	37.6
2019	35	65	102	35	4.2	241.2	41.9
2020	40	60	110	36.1	5	251.1	45.2
2021	35	55	95	44.1	4.5	233.6	41.1

Source: Compiled by the researchers based on Appendix No. 1

4- Contribution of renewable energy sources to carbon emission reduction in Germany during the period (2011-2021):

The contribution of renewable energy sources to carbon emission reduction in Germany has consistently increased over the period from (2011) to (2021). In (2011), it stood at (130.3) million tons, rising steadily to (221.4) million tons in (2021), representing a 69% increase compared to (2011).

In terms of the contribution of different types of renewable energy to carbon emission reduction in Germany in (2021), it varies significantly. Wind energy accounted for the highest percentage, contributing 39% of the total reduction, which equals (86.5) million tons. This was followed by biomass energy at 35%, contributing (79.2) million tons. Solar energy, hydropower, and geothermal energy contributed (36.8) million tons, (15.4) million tons, and (2.4) million tons, respectively, to carbon emission reduction in Germany during the period (2011-2021). This translates to 16.62%, 6.95%, and 1.08% of the total reduction in (2021). The following table illustrates the contribution of renewable energy sources to carbon emission reduction in Germany during the period (2011-2021):

Table No. (04): Contribution of renewable energy sources to carbon emission reduction in Germany during the period (2011-2021)

Unit: Million Tons

Year	Hydropower energy	Wind energy	Solar energy	Geothermal Energy	Biomass Energy	Total
2011	14.7	38	16	1.1	60.6	130.3
2012	16.6	34	18.4	1.2	64.6	134.8
2013	16.3	37	20	1.3	63.4	138
2014	15.4	44.3	25.4	1.6	65.1	151.8
2015	14.8	59	27.5	1.7	67	170.2
2016	15.8	58.7	27	1.9	67.1	170.6
2017	14.9	73.8	27	2.2	66.9	184.9
2018	13.2	77.9	30.2	2.5	69.4	193.3
2019	15.9	95.6	33.9	2.4	73.4	221.8
2020	14.7	99.9	36.9	2.5	77.1	231.9
2021	15.4	86.5	36.8	2.4	79.2	221.4

Source : German Environment Agency, Renewable Energies in Germany Data on the development in 2021, background // march 2022,p24

4- **The gradual decrease in the total contribution of the fuel sector to energy generation in Germany during the period (2011-2021):** The following table demonstrates the gradual reduction in the total contribution of the fuel sector to energy generation in Germany during the period (2011-2021):

Table No. (05): The gradual decrease in the total contribution of the fuel sector to electricity generation in Germany (2011-2021)

Unit: Million Kilowatt-hours

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
The amount of energy produced	3.781	3.738	3.843	3.664	3.687	3.750	3.759	3.650	3.560	3.305	3.390

Source: Compiled by researchers based on Appendix No. 2

From the table above, we can observe the German authorities' efforts to reduce reliance on conventional energy sources (such as oil, gas, and coal) during the period from (2011) to (2021). There has been a gradual decrease in the dependence on traditional energy sources by (391,000) kilowatt-hours. In (2011), the reliance was estimated at (3.781) million kilowatt-hours, while in (2021), it decreased to (3.390) million kilowatt-hours. This shift is notable considering the increasing energy demands of the German economy, highlighting Germany's commitment to replacing traditional energy sources with renewable ones as part of sustainable development efforts.

5- Contribution of renewable energies to the sectors (transportation, heating, cooling, electricity) during the period (2011-2021):

Germany has made considerable progress in its contribution to the heating sector, specifically in operating engines for heating and cooling purposes. Its contribution amounted to 16.5% of the total energy used for this purpose. This sector has experienced continuous growth, starting at 14% in (2012) and gradually increasing to a growth rate estimated at 2.5% of the total energy generated for heating purposes in (2021).

In the transportation sector, the contribution of renewable energies remains modest, as it did not exceed 6.8% in (2021) of the total energy used in the transportation sector, compared to 5% in (2012). The following table depicts the role of renewable energies in the sectors (transportation, heating, cooling, and electricity) during the period (2011-2021):

Table No. (06): Position of renewable energies in the sectors (transportation, heating, cooling, electricity) during the period (2012-2021):

Unit: Percentage

Years	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Heating/Cooling	14	13.9	13.8	14.7	14.6	14.7	15	15.1	15.8	16.5
Transportation	5	5.1	4.9	4.9	5.7	5.8	6	6	7.1	6.8

Source: Compiled by the researchers based on Appendix No. 3

6- Contribution of renewable energies to employment in Germany during the period (2011-2021):

Germany has managed to create permanent employment opportunities in various sectors of renewable energies. In (2021), there were approximately (350,000) job positions, compared to 416,700 in (2011). The number of job positions experienced a continuous decline, reaching (300,000) in (2019). However, there was a subsequent increase of (50,000) job positions in (2021) compared to (2011). The table below illustrates the contribution of renewable energies to employment in Germany during the period (2011-2021):

Table No. (06): Contribution of renewable energies to employment in Germany during the period (2011-2021):

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number of positions	416700	398100	357700	338700	338500	349100	315000	304400	300000	340000	350000

Source: Compiled by the researchers based on Appendix No. 4

7- Future goals of the energy transition in Germany:

The new German government has outlined ambitious targets, aiming to achieve:

- Achieving carbon neutrality by (2050).
- Reducing greenhouse gas emissions by 65% by (2030) compared to (1990) levels.
- Gradually phasing out coal by 2038 (Berlin Energy Transition Dialogue, p.2).

Conclusion:

Germany is progressing steadily towards achieving energy transition and gradually phasing out its reliance on non-renewable energy sources such as oil, gas, and coal. This is being achieved through the adoption of a series of stringent and determined measures implemented over the years, guided by a long-term strategy extending until (2050). Through this strategy, Germany is working to develop and harness various types of renewable energy sources with the aim of achieving energy self-sufficiency. Additionally, Germany seeks to control and reduce carbon emissions to preserve the natural environment and mitigate negative climate impacts within the country. This has made Germany an important and effective player in the German economy, with renewable energies now contributing 40% of the total electricity generated and 20% of the overall energy consumption.

Results:

- Infrastructure projects related to renewable energy supply have seen rapid development in Germany. A notable example is the significant growth of electric charging stations, with their number increasing by approximately 51,000 between (2012 -2021).
- The German model is considered a pioneering model both at the European and global levels in the development of the renewable energy sector. This is evidenced by the ambitious future targets Germany aims to reach, including achieving carbon neutrality by (2050).
- Despite its cold climate, Germany has managed to develop the solar energy sector, despite the limited number of sunny days.
- Electricity generated from wind energy is considered the most important renewable energy source in Germany due to its climatic conditions, which result in wind blowing throughout the year. The electricity generated from wind energy amounted to 95 million kilowatt-hours in (2021), representing 40.66% of the total electricity generated from renewable sources during the same year.

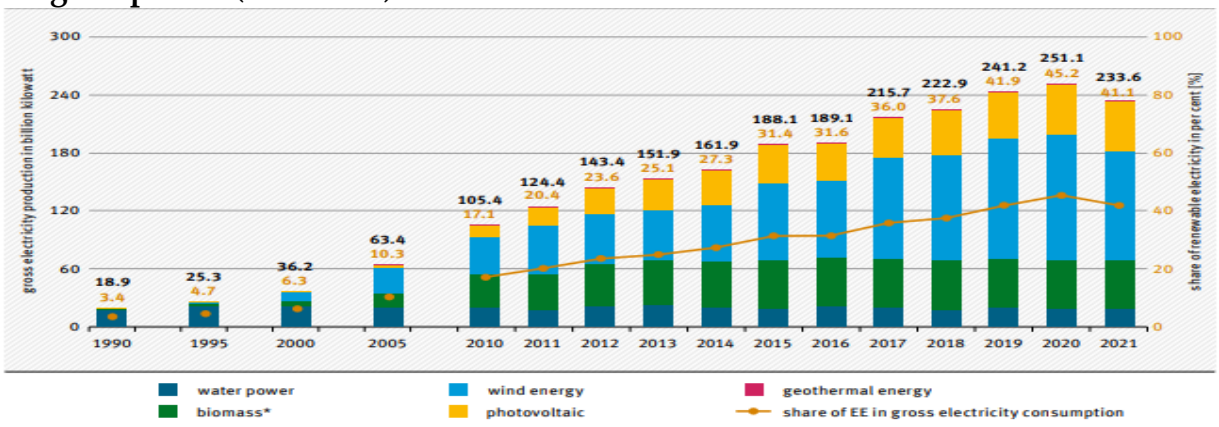
- Despite a substantial annual increase in energy demand, Germany has succeeded in partially controlling and mitigating greenhouse gas emissions. In (2021), emissions were estimated at 221.4 million tons, compared to 130.3 million tons in (2011) from conventional sources. This achievement is notable given the significant growth and development experienced by the German economy.
- Scientific research plays a crucial role in the development of renewable energy sources within Germany, benefitting from the wide array of specializations offered by German universities which work on developing the efficiency of utilizing diverse types of renewable energy sources.
- Despite substantial advancements in Germany's renewable energy sector, its contribution remains relatively low in transportation, heating, and cooling sectors, accounting for 6.8% and 16.5% respectively in (2021).
- The employment contribution of the renewable energy sector is modest, with the workforce not surpassing 350,000 workers as of (2021), despite the ongoing development of the sector.

Recommendations:

- The necessity of generalizing the German model to the world, especially third world countries.
- Encouraging international cooperation in the field of renewable energies.
- Providing advanced technologies to third world countries in the field of renewable energies, especially solar energy, which is available in most developing countries.

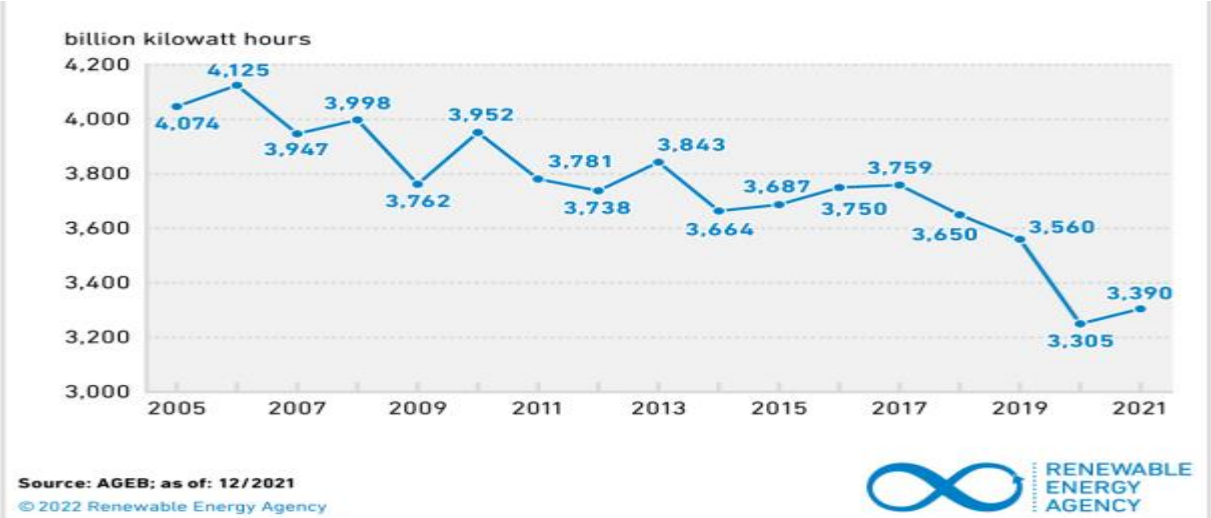
Appendix List:

Appendix No. (01): Electricity generation from renewable sources in Germany during the period (2011-2021)



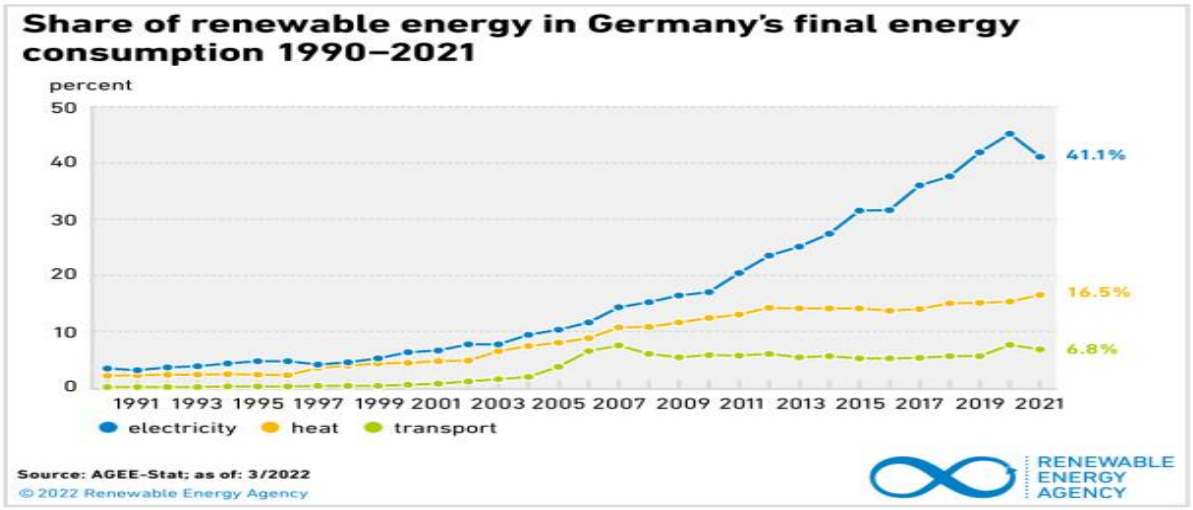
Source : German Environment Agency, Renewable Energies in Germany Data on the development in 2021, background // march 2022,p7

Appendix No. (02): Gradual decline in the total contribution of the fossil fuel sector to electricity generation in Germany (2011-2021)



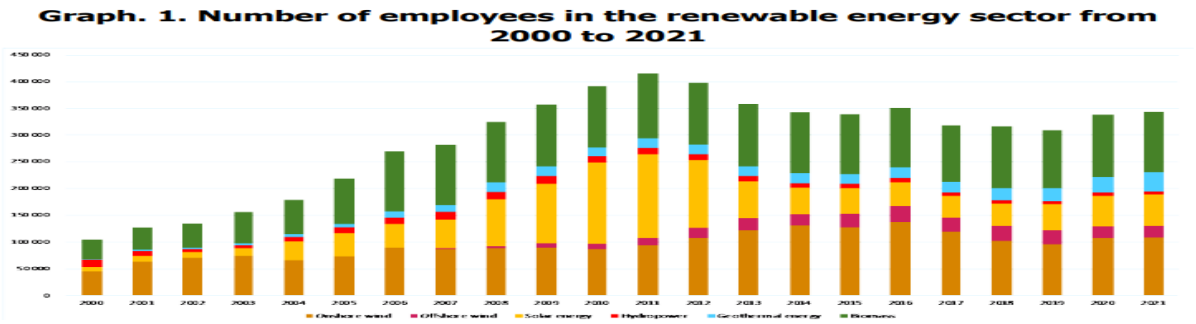
Source :Berlin Energy Transitions Dialogue 2022 ; Key Facts about the Energy Transition in Germany ;p3

Appendix No. (03): The position of renewable energies in the sectors of transport, heat (heating, cooling), and electricity during the period 2011-2021



Source :Berlin energy transition dialogue22 ; Key Facts about the Energy Transition in Germany ;p5

Appendix No. (04): Contribution of renewable energies to employment in Germany during the period 2011-2021



Source : BRIEFINGS DE LIFRI, Center for Energy & Climate , Higher Renewable Energy Targets in Germany, JANUARY 6, 2023p3

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